Developing Techniques to measure (d,p) on ^{132}Sn

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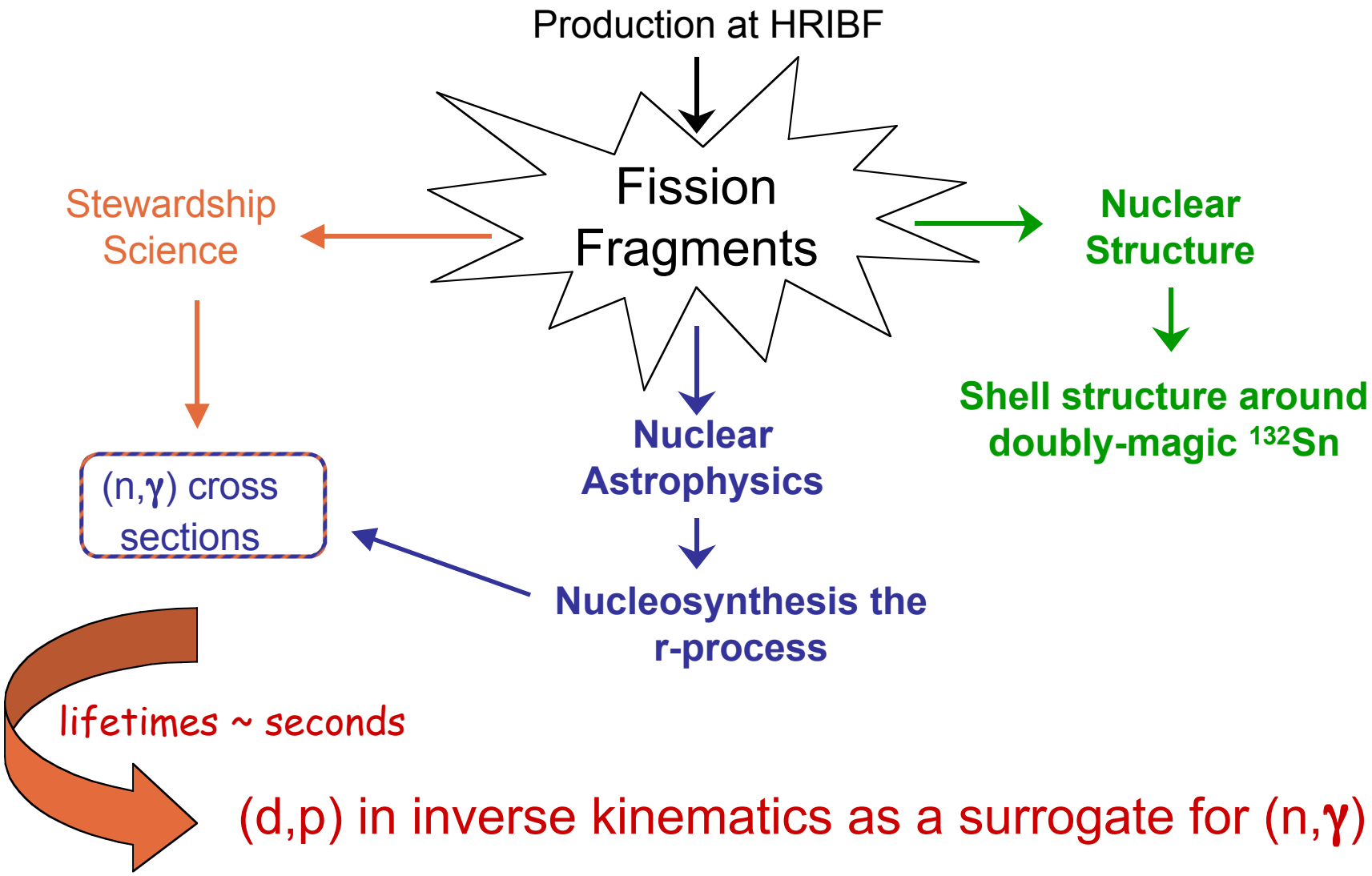
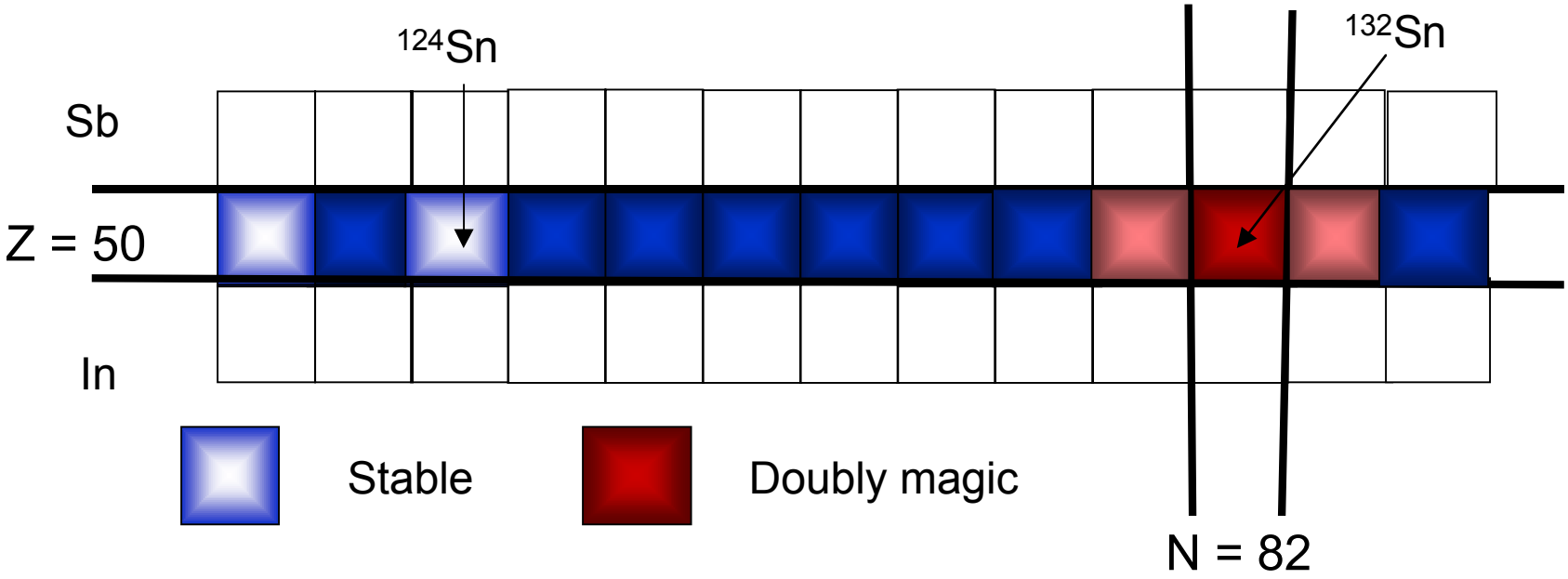
Why study (d,p) reactions for neutron-rich Sn isotopes?



Nuclear Structure
Neutron rich Sn Isotopes



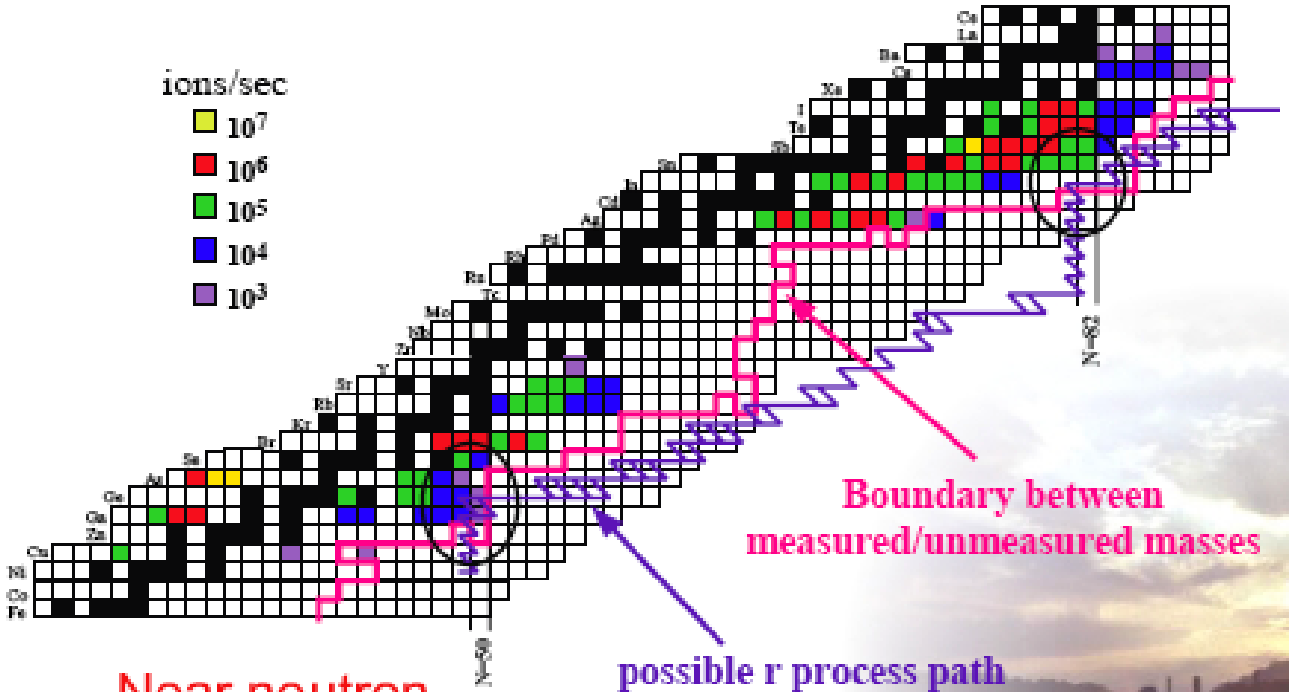
What's known about ^{133}Sn?

- 4 transitions from ^{134}In(**β**n)^{133}Sn [1)]
- 1561 keV confirmed in ^{248}Cm SF [2)]
- Level structure inferred from systematics, transition intensities and SM calcs.

Assignments need to be confirmed and spectroscopic factors need to be measured

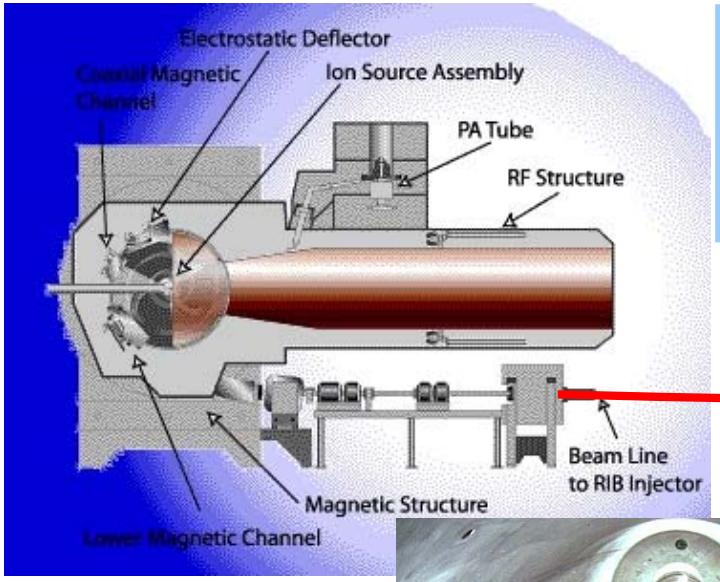
[1)]P. Hoff et al. PRL **77** (96) 1020. [2)] W. Urban et al. Eur. Phys. J **A5** (99) 239.

HRIBF Beams Available



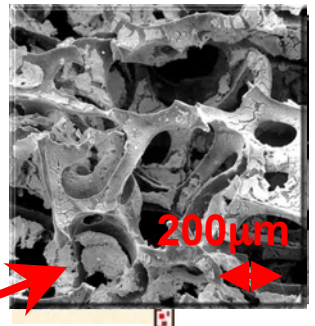
Near neutron closed shells N = 50 and 82, experiments with RIBs on or near r-process path are possible.

The Holifield RIB Facility



ORIC

p, d, or a



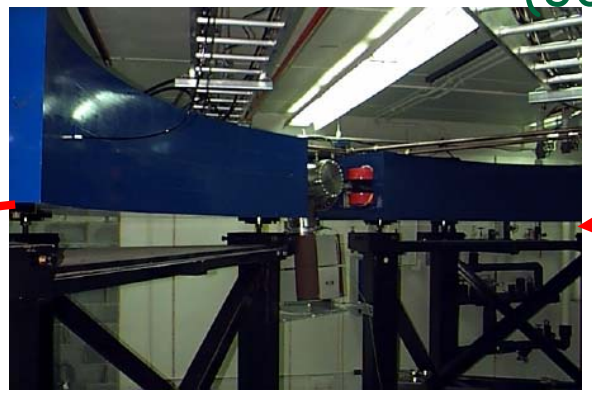
Fibrous UC_2 production target

Ion source

RIB (300 keV)

25 MV tandem

Mass analysis



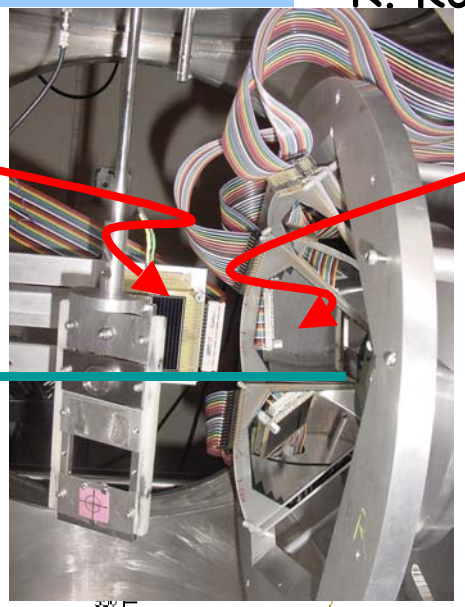
To experiments

^{124}Sn(d,p) test experiment

K. L. Jones,
R. Kozub et al.

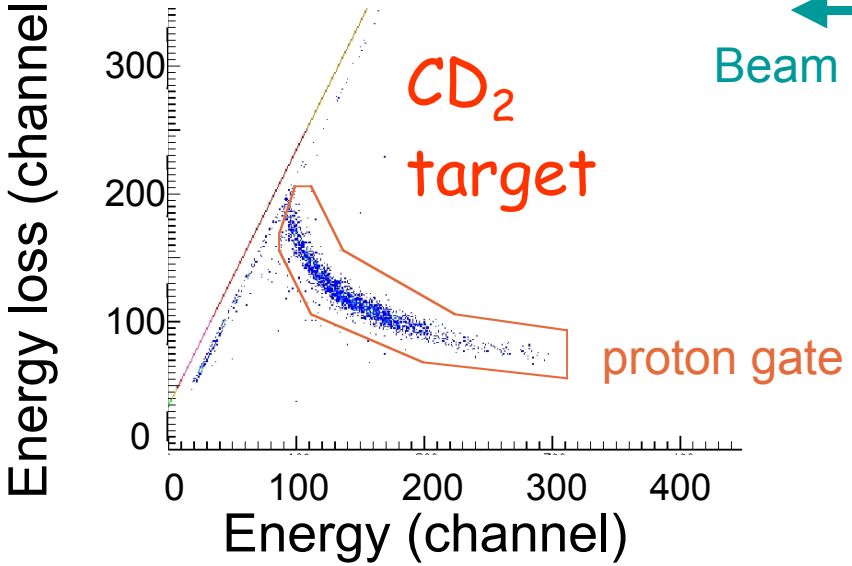
2D position sensitive Si detector telescope

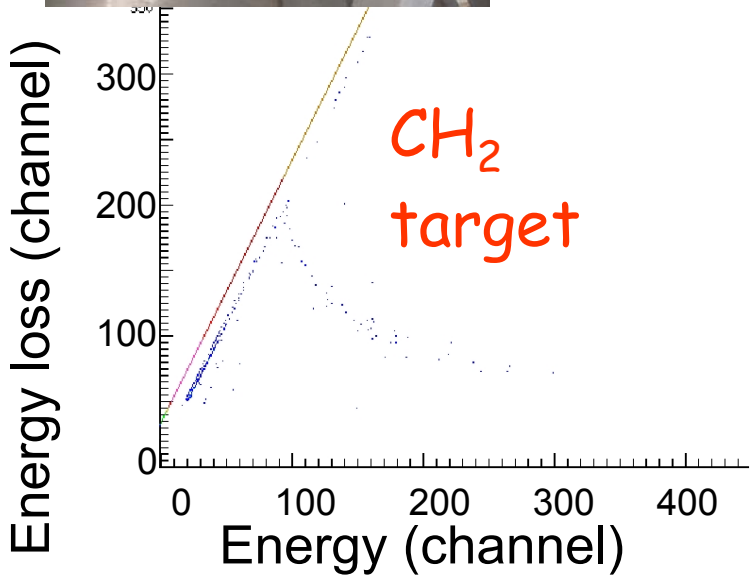
SIDAR in _ lampshade configuration



Beam direction

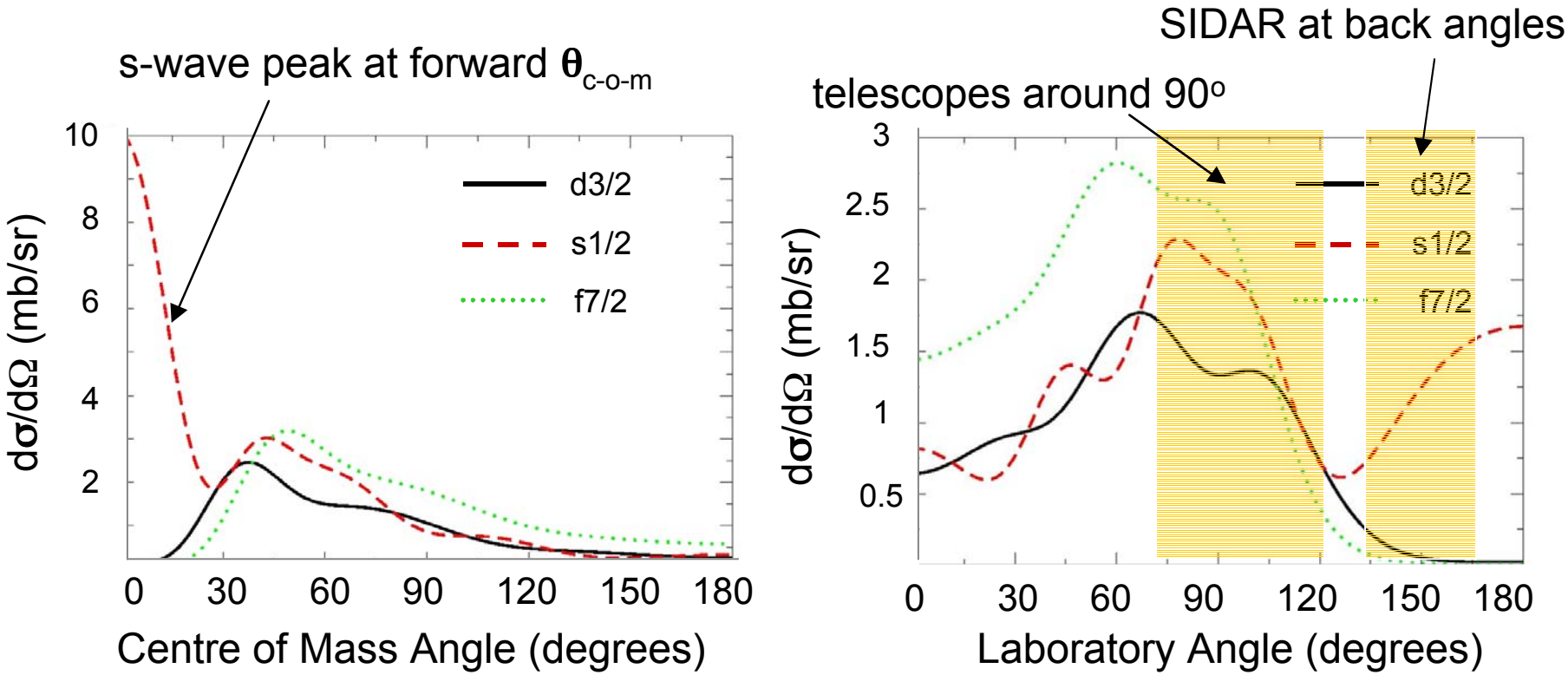
Proton Identification





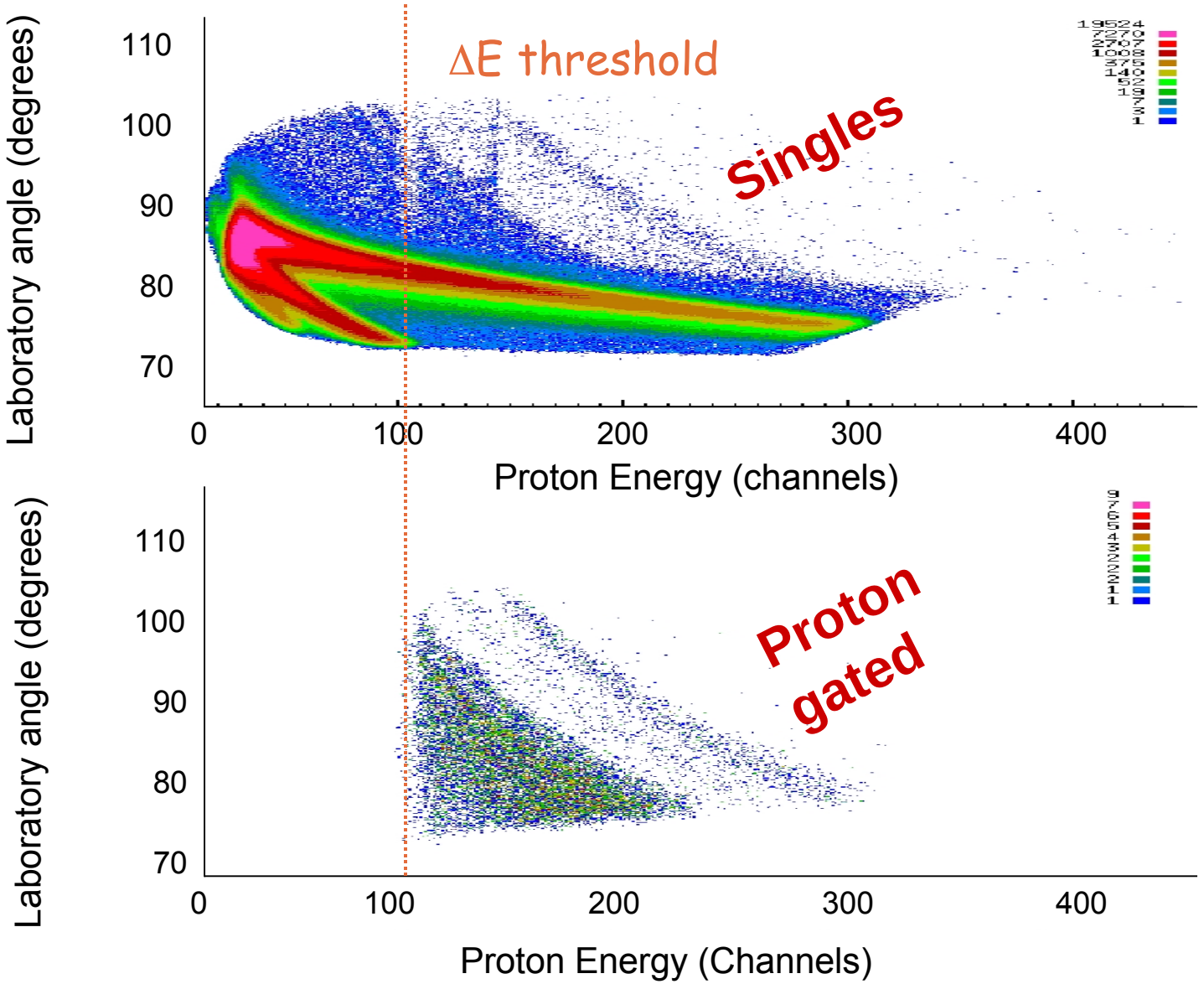
Very low background rate

$^{2}H(^{124}Sn,p)$ kinematics @ 4.25 AMeV
DWBA calculations

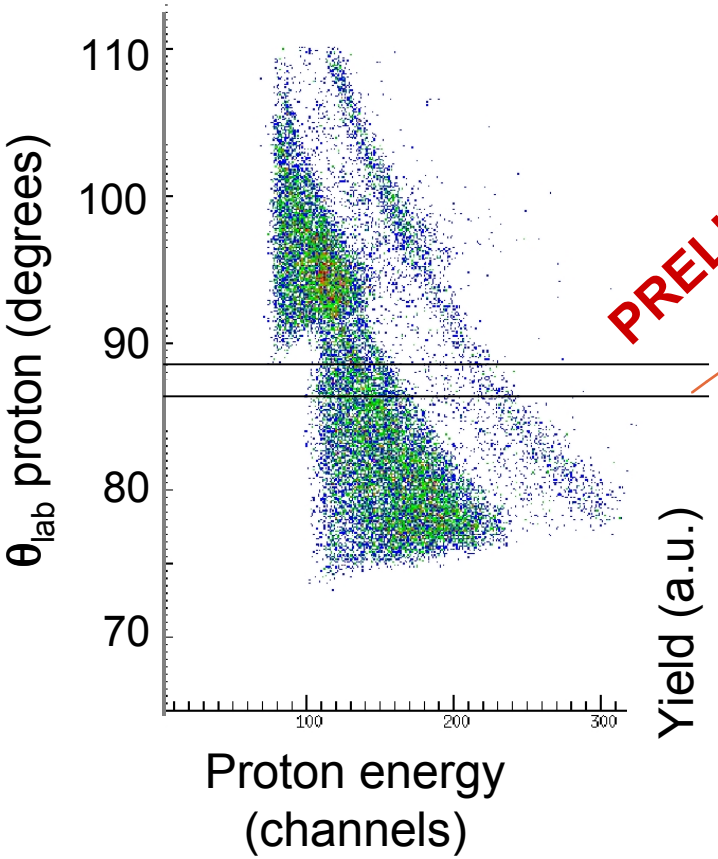


Forward $\theta_{c\text{-}o\text{-}m}$ — Backward θ_{lab}

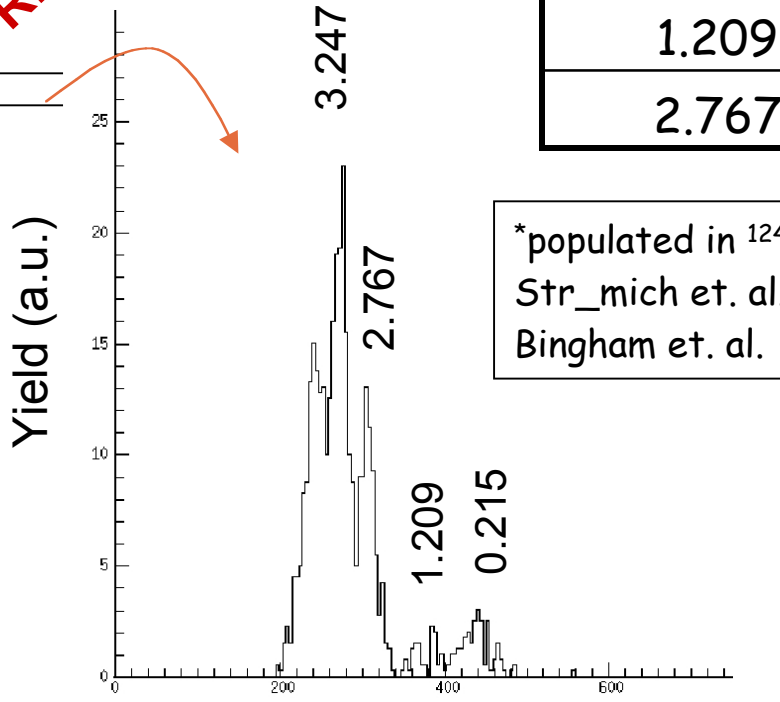
^{124}Sn(d,p) test experiment: energy-angle systematics



^{124}Sn(d,p) test experiment: results



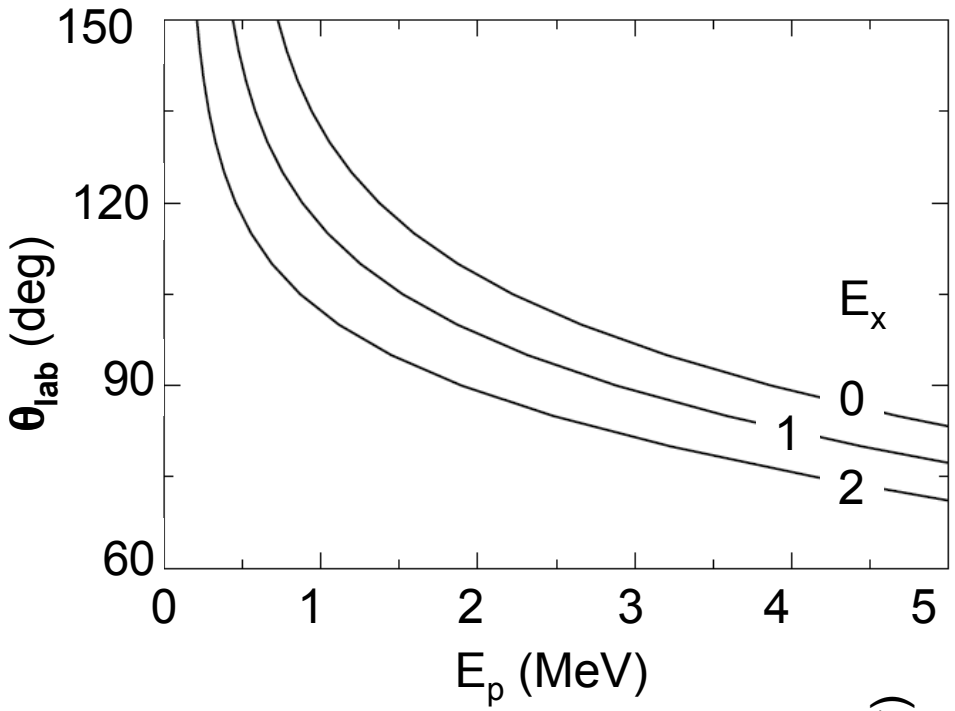
PRELIMINARY



E_x (MeV) Accepted*	J^π accepted
0.028	$3/2^+$
0.215	$1/2^+$
1.209	?
2.767	7/2-

*populated in ^{124}Sn(d,p) e.g. A. Str_mich et. al. PRC 16 (6) 1977 C. Bingham et. al. PRC 8 (2) 1973

d(^{132}Sn,p) kinematics @ 4.7 AMeV

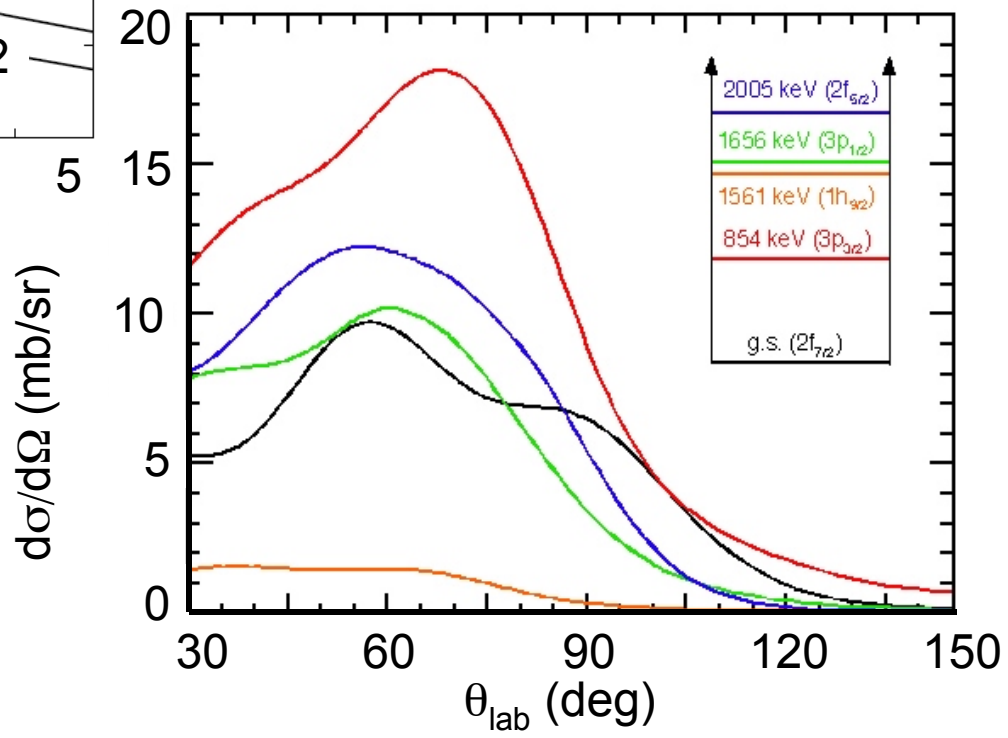


Forward $\theta_{c\text{-}o\text{-}m}$ _ backward θ_{lab}

At backward θ_{lab} cross section very small and E_{proton} v. small.

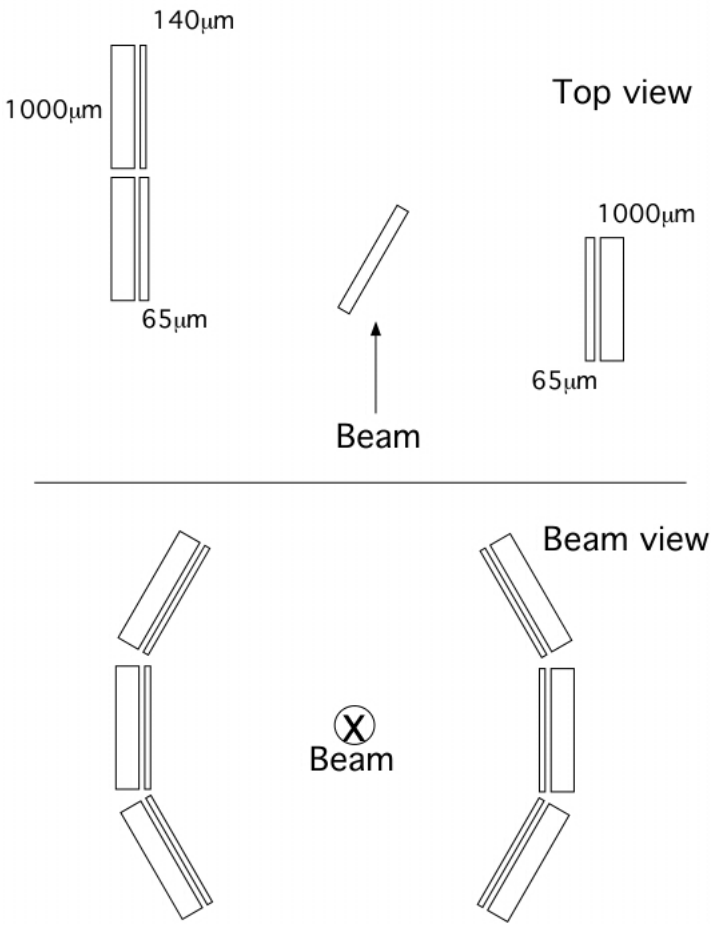
At forward θ_{lab} E_{proton} rises quickly with angle ($dE/d\theta$ is large).

Want to measure around 90°.



^{132}Sn(d,p) experiment: detectors

Forward angles:
high energy protons



Backward angles:
low energy protons

Angular Coverage: 45° to 110°
Solid Angle ~ 10%

Conclusions

- Neutron-rich beams produced via fission open up very exciting possibilities for transfer reactions in inverse kinematics.
- Test experiment using stable ^{124}Sn shows promising results,
- Further analysis required _ angular distributions.
- Large solid angle array around 90^{o} required to measure with RIB, expect around 10^{5} pps ^{132}Sn.